

UNITED STATES PATENT OFFICE.

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PROCESS OF ELECTROPLATING.

964,096.

Specification of Letters Patent. Patented July 12, 1910.

No Drawing.

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To all whom it may concern:

Be it known that I, THOMAS A. EDISON, a citizen of the United States, residing at Llewellyn Park, Orange, county of Essex, and State of New Jersey, have invented a certain new and useful Process of Electroplating, of which the following is a description.

In carrying on experimental and commercial operations in connection with electroplating, I find that the occlusion of hydrogen tends to make the deposit somewhat brittle and more or less porous, and that hydrogen gas clings to the surfaces of the deposited metal in the form of very fine bubbles, thereby making the surfaces more or less warty and rough. The presence of occluded hydrogen, as well as of the hydrogen bubbles referred to, prevents the deposition at a high rate, and also results in streaky and uneven deposits.

My object is to provide an improved process of electroplating, whereby I very largely eliminate the occlusion of hydrogen, as well as the formation of hydrogen bubbles on the deposited surfaces, and in consequence I am enabled to carry on a plating operation at a much higher rate than is now possible, and at the same time with the production of a better quality of deposit, less brittle in character, practically free of pores, and with a smooth and uniform surface.

The invention resides in the fact that by maintaining in the plating bath a small quantity of material which will combine with the hydrogen, for example, free chlorine, the latter will combine with any hydrogen set free by the electrolytic action, or otherwise, thereby preventing the formation of metallic hydrates as well as the occlusion of the gas, and eliminating also the appearance of microscopic bubbles thereof, which cling to the deposited surfaces with the objections pointed out. When free chlorine is thus present in the bath, it combines with any hydrogen generated therein to form hydrochloric acid, although it is possible that other favorable reactions may be brought about by the presence of free chlorine. The chlorine may be added to the plating bath in any suitable

way, such, for example, as by passing the gas continuously, or at suitable intervals, through the bath; by adding to the bath, water saturated with chlorine, or by adding from time to time fresh quantities of the electrolyte saturated with chlorine. For instance, if copper is to be plated from a solution of sulfate of copper, the chlorine can be added by chlorinating a suitable quantity of the solution, which can be added from time to time in small amounts to the solution as the chlorine becomes exhausted. In practice, the solution should have a slightly acid reaction. I find that the effect of the chlorine thus introduced into the bath lasts for several hours, when a fresh quantity must be added. In the case of a chlorid bath (for instance, chlorid of cobalt) a platinum or carbon anode of very small surface can be connected to the metallic anode and made to continuously chlorinate the solution, as will be understood. Practically all of the chlorine is utilized in combining with the hydrogen developed, there being very little loss of chlorine by its combination with either the anode or cathode. Free bromine may also be employed, but with results that are far inferior to those secured when chlorine is used. The use of chlorine in cobalt plating baths is especially beneficial, and this is particularly true when cobalt-chlorid solutions are employed.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is as follows:—

1. That improvement in the art of electroplating which consists in chlorinating a suitable quantity of copper sulfate solution, and adding from time to time in small amounts to the solution in a copper plating bath, as the chlorine becomes exhausted by reaction with the hydrogen developed upon the cathode, substantially as set forth.

2. That improvement in the art of electroplating which consists in chlorinating a suitable quantity of copper sulfate solution, and adding from time to time in small amounts to the solution in a copper plating bath, as the chlorine becomes exhausted by reaction with the hydrogen developed upon

the cathode, the solution being maintained slightly acid, substantially as set forth.

3. That improvement in the art of electroplating which consists in halogenizing a
5 suitable quantity of copper sulfate solution, and adding from time to time in small amounts to the solution in a copper plating bath, as the halogen becomes exhausted by

reaction with the hydrogen developed upon the cathode, substantially as set forth. 10

This specification signed and witnessed this 24th day of Februry 1906.

THOMAS A. EDISON.

Witnesses:

FRANK L. DYER,
ANNA R. KLEHM.